

***Wilkiea kaarruana* Zich & A.J.Ford (Monimiaceae), a new species from north-east Queensland**

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Summary

Zich, F. & Ford, A.J. (2011). *Wilkiea kaarruana* Zich & A.J.Ford (Monimiaceae), a new species from north-east Queensland. *Austrobaileya* **8(3): 405–411**. *Wilkiea kaarruana* Zich & A.J.Ford endemic to the Wet Tropics of north-east Queensland is described, illustrated and distinguished from related Australian species. Notes on habitat, distribution, and conservation status are provided.

Key Words: Monimiaceae, *Wilkiea*, *Wilkiea kaarruana*, Australia flora, Queensland flora, new species, taxonomy, identification key, hyperstigma

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Introduction

Wilkiea F.Muell. (Monimiaceae) is a genus of approximately 12 species distributed from Papua New Guinea to Australia (Philipson 1980; Whiffin & Foreman 2007). In their treatment of the genus for the *Flora of Australia*, Whiffin & Foreman (2007) elected not to describe two poorly known taxa from north Queensland. Recent collections of one of these taxa, *Wilkiea* sp. A (Whiffin & Foreman 2007) by the authors have provided for the first time female flowers, and abundant new male flowering specimens, which have enabled confident placement of the taxon in the genus *Wilkiea*.

The flowers of *Wilkiea* have been recorded as possessing a hyperstigma (Endress 1979, 1980); that is, a sticky surface receiving pollen that is not the stigma itself. Mucilaginous secretion from the stigmas as a reward for pollinators has been reported for at least one other genus of Monimiaceae, namely the Madagascan *Tambourissa* Sonn. (Lorence 1985), which is pollinated by flies and beetles, while the pollination of Australian *Wilkiea huegeliana* (Tul.) A.DC. appears to be mainly by thrips (Williams *et al.* 2001).

Staedler & Endress (2009) have revealed that all taxa in Monimiaceae that possess a hyperstigma also have a complex, whorled floral phyllotaxis, in which merism may increase or decrease once or several times between whorls. They call organs tepals when they are anywhere on the floral cup (regardless of whether on top of the cup or toward the base of the cup), and bracts when they are below the floral cup on the pedicel.

Materials and methods

The study is based upon the examination of herbarium material from BRI and CNS (formerly QRS) combined with field observations. All specimens cited have been seen by one or both authors.

Measurements of the floral parts of *Wilkiea kaarruana* are based on fresh material and material preserved in 70% ethanol. Common abbreviations in the specimen citations are: L.A. (Logging Area), N.P./R. (National Park/Reserve), S.F./R. (State Forest/Reserve) and T.R. (Timber Reserve).

NCA is an acronym for the Queensland Nature Conservation Act (1992) and its associated schedules. Discussions of conservation status are made in reference to the criteria of the IUCN (2001).

The abbreviation RE in the distribution and habitat notes refers to Regional Ecosystem, descriptions of which can be viewed at (in this case):

http://www.derm.qld.gov.au/wildlife-ecosystems/biodiversity/regional_ecosystems/search.php?&page=31

Extent of occurrence estimates were derived from the validation of original collection localities. These data points were loaded into ESRI ArcView 3.2 and the draw polygon feature was used to calculate the area between the points. The area of occupation estimates were principally derived from a digital Regional Ecosystem map supplemented by expert opinion of vegetation types and habitats within the Wet Tropics bioregion (hereafter referred to as the Wet Tropics) (Environment Australia 2005).

Taxonomy

Wilkiea kaarruana Zich & A.J.Ford, **species nova** affinis *Wilkiea smithii* Whiffin a qua cortice suberoso, ramulis glabris, pedicellis glabris, floribus femineis longioribus (22–24 mm longis), et stigmatе conico differt. **Typus:** Queensland. COOK DISTRICT: Wooroonooran National Park, 9.5 km along Maple Creek Road from South Johnstone River bridge, 20 November 2007, *A. Ford 5205* (holo: BRI; iso: A, BO, CANB, CNS, H, K, L, LAE, MO, NSW, SYD, MEL, SING, US, *Z. distribuendi*).

Wilkiea sp. Palmerston (B.P.Hyland 80); Jessup (2007, 2010).

Wilkiea sp. Palmerston (BH 80RFK); Hyland *et al.* (2003).

Wilkiea sp. Palmerston; Cooper & Cooper (2004: 320).

Wilkiea sp. A; Whiffin & Foreman (2007: 81).

Illustration: Cooper & Cooper (2004: 320), as *Wilkiea* sp. (Palmerston).

Shrub or small tree 5–12 m tall, androdioecious or monoecious; bark corky, thick and longitudinally fissured. Leaves glabrous, slaty green above when fresh; petiole 5–12 mm long. pink-red; lamina elliptic to oblong-

elliptic, 6–15 cm long, 2.5–6 cm wide, cuneate to attenuate at base, entire, acuminate at apex, mucronate; midrib raised above and below. Male inflorescence axillary, terminal and ramiflorous, often fasciculate, 1–4 cm long; occasionally solitary, mostly triads (botryoids sensu Endress [2010]), sometimes fascicles of triads (botryoids), in total 1–15 flowers; pedicels 5–18 mm long, glabrous; bracts lanceolate, *c.* 1.1 mm long. Male flowers globose to depressed globose, *c.* 2–3.5 mm wide, yellow to yellow-orange; tepals rounded to truncate 4–6, *c.* 1.8 mm long, glabrous on both surfaces, two pairs around ostiole, third pair if present near base of floral cup; stamens 4, *c.* 1.1 mm long, in equal pairs, outer 2 positioned on floral cup wall and higher than inner two which are positioned on the base of receptacle, anthers opening by apical slit curving over apex, filaments very short, hairy. Female inflorescence terminal, 3–5 cm long, fascicles of triads (botryoids), in total 6–14 flowers, pedicels 11–24 mm long, glabrous. Female flowers depressed globose, *c.* 7 mm diameter, yellow-orange fading to green at base; tepals 4–6, 2 pairs around ostiole, outer pair thin, inner pair greatly thickened, forming a floral cup, third pair when present often consisting of one tepal near the base of floral cup and the opposing tepal on the side of the floral cup; carpels 21–26, angular, tapering, densely pubescent with golden, more or less appressed hairs; stigma short, conical and black; staminodes absent. Fruiting receptacle, 6–10(–15) mm wide, pubescent; mature fruit not known. **Fig. 1.**

Additional selected specimens examined: Queensland. COOK DISTRICT: Big Tableland via Cooktown, *s.dat.*, *Jack in Eldridge s.n.* (BRI [AQ63833]); Gap Creek, *c.* 22 miles [36 km] S by E of Cooktown, Oct 1969, *Smith s.n.* (BRI [AQ339983]); *loc. cit.*, *Smith s.n.* (BRI [AQ339984]); *loc. cit.*, *Smith s.n.* (BRI [AQ339988]); Daintree N.P., Cedar Bay Section, Gap Creek, Nov 2000, *Forster PIF26462 et al.* (BRI); Daintree N.P., Daintree River headwaters, May 1998, *Forster PIF22947 et al.* (BRI); Mitchell Bomber crash site, East Bartle Frere, Wooroonooran N.P., Nov 1994, *Hunter 2147* (BRI); Jordan L.A., 16.5 km SE of Millaa Millaa, site 2, Oct 1988, *Jessup GJM 2095 et al.* (BRI); Wooroonooran N.P., 1.1 km along K-Tree road from Kaarru Creek crossing, Nov 2007, *Ford 5208¹* (BRI, CNS); Wooroonooran N.P., 1.1 km along K-Tree road from Kaarru Creek crossing, Nov 2008, *Zich 626¹* (BRI, CNS); Wooroonooran N.P., Maple Creek Road, CSIRO Climate Change Plot, Charappa, Nov

2008, Zich 627¹ (BRI, CANB, CNS); Palmerston F.R., old logging road towards Karang-Garee Falls, off South Johnstone Forestry road, Oct 2003, Ford 4174 & Holmes (BRI, CNS); (!= flowering specimen).

Distribution and habitat: *Wilkiea kaarruana* is endemic to the Wet Tropics bioregion in north-eastern Queensland, where it is currently known to occur from the Cooktown area (Big Tableland and Mt Finnigan environs) to the South Johnstone River (south-east of Millaa Millaa) (**Map 1**). However, within this large range *Wilkiea kaarruana* is confined to four distinct and disjunct populations (from north to south):

1. Mt Finnigan area (from Big Tableland to Gap Creek)
2. Daintree River headwaters
3. Mt Bartle Frere
4. South Johnstone River catchment.

It inhabits predominantly the wetter and more mountainous notophyll vine-forests/rainforests on soils derived from granite, fine grained metasediments (including mudstone) and basalt. However, it is more commonly encountered on granitic substrates, with occurrences on basalt and metasediments being less common. Common canopy species that grow in association with *Wilkiea kaarruana* include: *Cardwellia sublimis* F.Muell., *Carnarvonia araliifolia* F.Muell., *Cryptocarya mackinnoniana* F.Muell., *Doryphora aromatica* (F.M.Bailey) L.S.Sm., *Elaeocarpus ruminatus* F.Muell., *Flindersia bourjotiana* F.Muell., *Flindersia pimenteliana* F.Muell., *Franciscodendron laurifolium* (F.Muell.) B.Hyland & Steenis, *Sloanea macbrydei* F.Muell., *Syzygium johnsonii* (F.Muell.) B.Hyland, *Syzygium papyraceum* B.Hyland and *Xanthophyllum octandrum* (F.Muell.) Domin. Common small trees and shrubs throughout most of its range include: *Apodytes brachystylis* F.Muell., *Ardisia brevipedata* F.Muell., *Bobea myrtooides* (F.Muell.) Valetton, *Bubbia semecarpoides* (F.Muell.) B.L.Burtt, *Chionanthus axillaris* R.Br., *Citronella smythii* (F.Muell.) R.A.Howard, *Gossia* spp., *Pilidiostigma tropicum* L.S.Sm., *Pittosporum rubiginosum* A.Cunn., *Polyscias australiana* (F.Muell.)

Philipson and *Psychotria* spp. Altitudinal range, from existing specimens, is 60–1090 m.

Wilkiea kaarruana has been collected or reliably reported in the following REs: 7.8.2a (rarely); 7.11.1a (occasionally); 7.12.1a (occasionally), 7.12.16a (commonly) and 7.12.19a (rarely).

Phenology: Flowers have been recorded in October and November; immature fruits have been recorded in March.

Affinities: *Wilkiea kaarruana* is morphologically most similar to *W. smithii* and *W. hylandii* Whiffin. However these species are easily distinguished by several key features and geographic distribution. All three species have pubescent carpels and glabrous to glabrescent adaxial leaf surfaces. A comparison of diagnostic differences between these three species (and *Wilkiea austroqueenslandica*) is provided in **Table 1**.

Whiffin (2007) suggests that *Wilkiea austroqueenslandica*, *W. hylandii* and *W. smithii* form a “distinctive group”, as they all have pubescent inflorescences and carpels. Although *W. kaarruana* has glabrous inflorescences, the carpels are distinctly pubescent. Molecular studies by Renner *et al.* (2010, Fig. 2) and Renner *pers. comm.* (2009) place *Wilkiea kaarruana* close to *W. austroqueenslandica* Domin., *W. smithii* and *W. hylandii*.

Notes: In habitat *Wilkiea kaarruana* is easily recognized by the thick and longitudinally fissured pale corky bark. A specimen from the Big Tableland (*Jack in Eldridge s.n.*) consists of a piece of bark 20mm thick mounted on a sheet and the name “Corkwood Tree” on the original label. No other species of *Wilkiea*, or Monimiaceae, in Australia have this striking feature though it has been reported for at least two species of Monimiaceae on the island of New Guinea, currently assigned to the island endemic genus *Kairoa* Philipson (Renner & Takeuchi 2009). Recent molecular research on *Kairoa* indicates it should be included with *Wilkiea*, along with *Kibara* Endl., which is likewise embedded among species of *Wilkiea* (Renner *et al.* 2010).

Table 1. Morphological comparison between *Wilkiea austroqueenslandica*, *W. hylandii*, *W. kaarruana* and *W. smithii*

Character state	<i>W. austroqueenslandica</i>	<i>W. hylandii</i>	<i>W. kaarruana</i>	<i>W. smithii</i>
Bark	finely wrinkled	not recorded (but not corky)	corky	tessellated flaky
Leaf indumentum	glabrous	pubescent when young, glabrescent or persisting on midrib	glabrous	densely pubescent when young, esp. midrib, glabrescent
Leaf margin	prominently, irregularly toothed	prominently toothed in upper half	entire	entire
Male inflorescence position	axillary	axillary, sometimes fasciculate	axillary, terminal and ramiflorous, often fasciculate	axillary, sometimes fasciculate
Male inflorescence	triad or fascicle of triads	triad or fascicle of triads	occasionally solitary, mostly 2-flowered or sometimes triads or fascicle of triads	triad or fascicle of triads
Male flower pedicel length & indumentum	c. 8 mm densely pubescent	4–5 mm densely pubescent	5–18 mm glabrous	6–8 mm densely pubescent
Male flowers tepal number	8 as 4 pairs	6, with 2 pairs around ostiole, and 1 lower on floral cup	4 to 6. 2 as pairs around an ostiole. 3rd pair, if present at base of floral cup	8 in 2 whorls
Male flowers stamen number	30	(6) 8 (10)	4	usually 4
Female inflorescence position	axillary	axillary or terminal	terminal	axillary or terminal
Female flower pedicel length & indumentum	10–15 mm densely silky pubescent	7–15 mm densely pubescent	22–24 mm glabrous	5–8 mm densely pubescent
Female flower tepal number	4	4	4 or 6	4
Carpel number	35	40	21–26	20–40
Stigma shape	hemispherical	hemispherical	conical	hemispherical

Although *Wilkiea kaarruana* is a small tree, it is remarkable that there are so few fertile specimens in herbaria. The few flowering collections have sometimes made it difficult to determine levels of dioecy and monoecy. As noted by Whiffin & Foreman (2007) the genus *Wilkiea* is monoecious or perhaps rarely dioecious, and “It is likely that many (perhaps all) species described as dioecious have male and female flowers on the same plant but usually not at the same time. For example, many plants with mature fruit have young flowers that are male”. Observations made during this study corroborate these statements, with Ford 5208 having mature female flowers and younger male flowers. These male flowers would likely come into anthesis after the female flowers were fertilized. Also, despite regular monitoring of several plants before and after flowering, we found no evidence of male plants (Ford 5205 and Zich 628) ever producing female flowers. Accordingly, we suggest that *Wilkiea kaarruana* is androdioecious (male dioecious) and monoecious (having pure male plants growing together with monoecious plants). Further field observations are required to assess the reproductive strategy within *Wilkiea kaarruana*, and indeed for all Australian Monimiaceae.

Floral observations of female *Wilkiea kaarruana* conducted as part of this study have confirmed the presence of a hyperstigma. The outline of the flower is globular, the inner pair of tepals is greatly thickened and appears to produce mucilage at anthesis. The amount of mucilage in dissected flowers varied but was observed to fill the floral cup creating a continuous cover over the carpels to the apical pore (see **Fig. 1**). Despite examination of many flowers no insects or their larvae were found, though possible evidence of insect damage was observed in the partial destruction of the apical pore as described and illustrated by Endress (1980: 85, fig.35).

The presence of a third whorl of tepals in both male and female flowers in *W. kaarruana* is not unusual within *Wilkiea*; however, it is more usual for male flowers to possess more whorls than female flowers (Whiffin 2007).

Leaf oils in Australian species of *Wilkiea* have been studied by Brophy *et al.* (2009). *Wilkiea kaarruana* produced a sesquiterpenoid oil similar to the related *Wilkiea smithii* Whiffin; although this latter species also contained very small amounts of monoterpenes. *Wilkiea austroqueenslandica* Domin, another closely related species, yielded an oil also dominated by sesquiterpenes, but had a much higher proportion of monoterpenes. *Wilkiea hylandii* Whiffin was not sampled in their study.

Conservation status: Most existing collections of this species have been made within the World Heritage Area of the Wet Tropics. *Wilkiea kaarruana* has been collected in Daintree and Wooroonooran National Parks. The species has a wide, albeit restricted and disjunct geographical range with an area of occupation estimated to be 110 km². It is not considered at risk.

Etymology: The specific epithet honours Kaarru (pronounced Kaa-roo) Creek and Kaarru Logging Area, where several collections of the species, including the first female flowering collection were made. Now known as Wooroonooran National Park, the area was previously referred to as State Forest Reserve 756.

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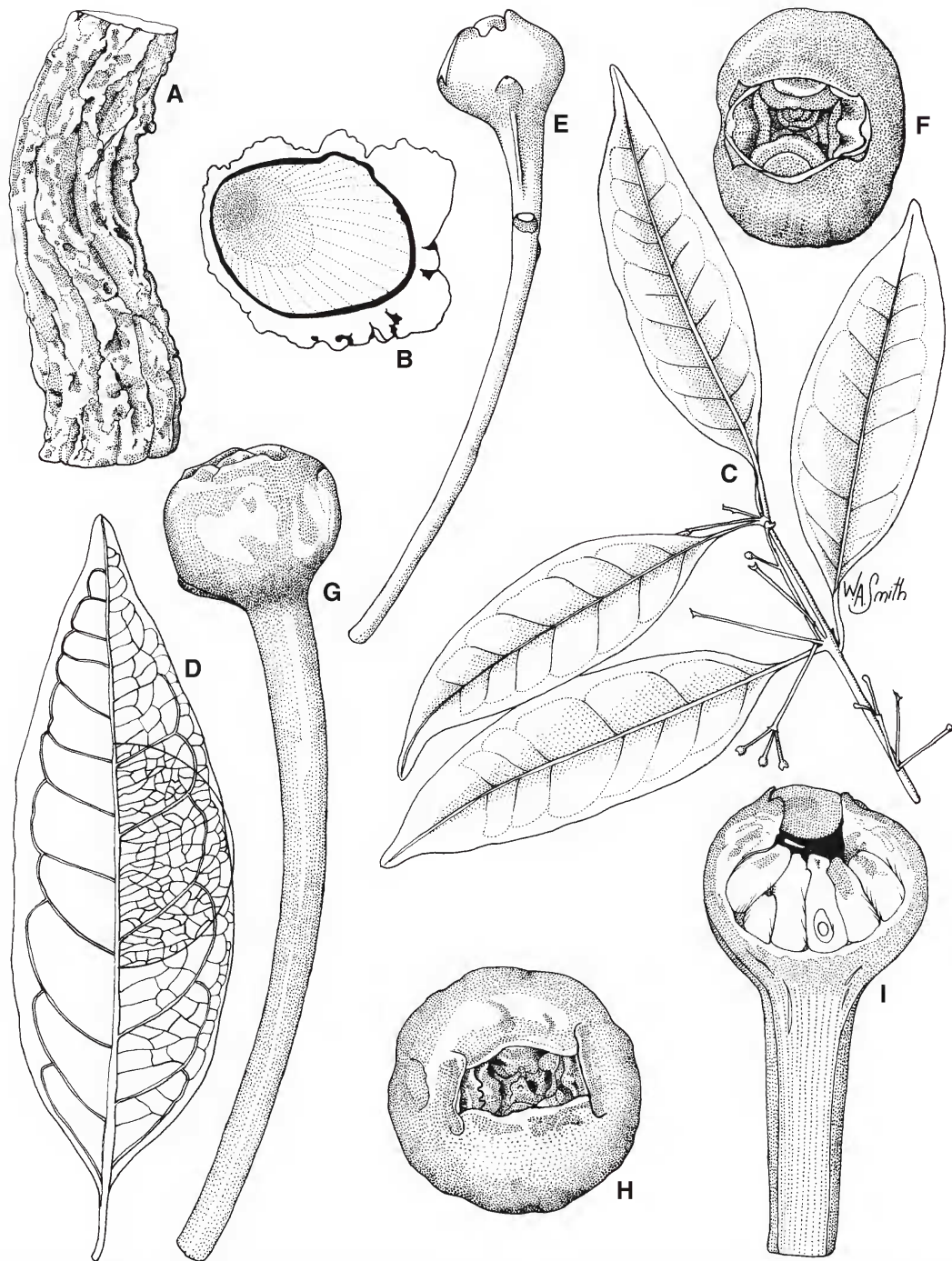
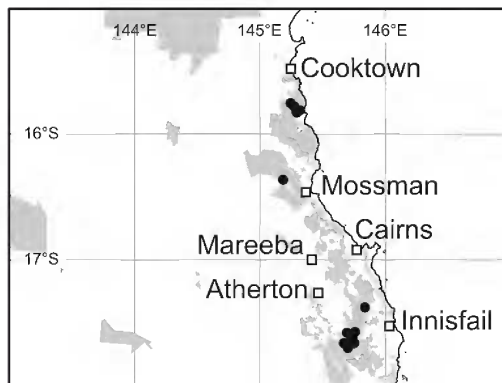


Fig. 1. *Wilkiea kaarruana*. A. large branch showing longitudinal corky fissures $\times 1$. B. transverse section of large branch $\times 2$. C. branchlet with male inflorescences $\times 0.5$. D. leaf adaxial surface with extra venation detail $\times 1$. E. lateral view of male flower showing off-set tepal on floral tube and bract on pedicel $\times 10$. F. face view of male flower showing tepals around ostiole and anthers $\times 12$. G. lateral view of female flower showing off-set tepals on floral cup $\times 10$. H. face view of female flower showing tepals around ostiole and off-set tepal on floral cup $\times 12$. I. section of female flower showing hairy carpels and mucilaginous cover from the hyperstigma $\times 12$. A–B from *Forster PIF26462 et al.* (BRI); C–F from *Ford AF5205* (CNS); G–I from *Ford AF5208* (CNS). Del. W. Smith

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Map 1. Distribution of *Wilkiea kaarruana* in Queensland. Shaded areas indicate conservation reserves.